1. Consider the following tree

A diagram of a company

Description automatically generated

1. Breadth first search – Show the order in which the nodes will be visited by placing a number next to the node in the figure. For example if node E will be visited as 6th node place 6 next to the node in the tree. S will always be 1. [10 points]

A diagram of a tree

Description automatically generated

b) Repeat a) for depth first search [10 points]

A diagram of a tree

Description automatically generated

c) Repeat a) for depth first search with limit l=3. [5 points]

A diagram of a tree

Description automatically generated

**2) Provide a complete problem formulation for the following. Problem formation should include: initial state, goal test, cost function. They can all be a few words or a sentence for each. [25 points]**

a) Using only four colors, you have to color a planar map in a way such that no two adjacent

regions have same color

***Initial State***- A planar map that has no coloring on the map to start with

***Goal Test***- All of the regions on the map need to have a color assigned, but the neighboring regions can not have the same color assigned

***Cost Function***- There is no cost function outlined in the problem, but a cost function could be to minimize the amount of regions, to reduce the amount of re-colorings

b) You have a program that outputs the message “illegal input record” when fed a certain file of

input records. You know that processing of each record is independent of the other records. You

want to discover what record is illegal.

***Initial State***- A bunch of input records but one record is illegal, and triggers the system to display the statement “illegal input record”.

***Goal Test***- Identify the specific record that is deemed illegal by the system

***Cost Function***- Minimize the number of records checked, and identify the record that is the illegal one.

**3) Your goal is to navigate a robot out of a maze. The robot starts in the center of the maze facing north. You can turn the robot to face north, east, south, or west. You can direct the robot to move forward a certain distance although it will stop after hitting a wall. [20 points]**

a) Formulate this problem. This means you will have to describe initial state, goal test, successor

function, and cost function. Successor function is a description of the robots successive actions

after the initial state.

We will define the coordinate system so that the center of the maze is at (0, 0), and the maze

itself is a square from (−1,−1) to (1, 1)

***Initial State***: Robot at (0, 0) facing north.

***Goal Test***: Reach (0, 1), (1, 0), (0, -1), or (-1, 0) with the corresponding orientation.

***Successor Function***: Turn right, turn left, move forward (stop at walls).

***Cost Function***: All actions have a uniform cost of 1.